Original Research Article

Comparative Economic Evaluation of integrated and non-integrated farming systems in Northeastern Karnataka

Abstract

Integrated Farming System (IFS) represented a holistic approach to managing farm resources, aimed at boosting productivity, minimizing environmental impact, enhancing incomes for resource-poor farmers, and ensuring agricultural sustainability.Multi-stage random sampling technique was used, beginning with Ballari district, followed by selecting one taluk with the highest net sown area, and then two villages within that taluk. From each village, 10 IFS and 10 non-IFS farmers were randomly selected, totaling 40 farmers. This study analyzed the costs and returns of major IFS and non-IFS practices in Ballari district, Karnataka. Data were collected from 40 farmers in two villages within Ballari taluk during the agricultural year 2017-18 and were analyzed using tabular and budgeting methods. The results revealed that farmers in the area used three distinct farming systems: IFS-I (Crop + Dairy), IFS-II (Crop + Dairy + Small Ruminants), and Non-IFS (Crop only). Major crops included paddy, dry chili, cotton, and jowar. The analysis showed that IFS-II, which integrated crops, dairy, and small ruminants, generated the highest net returns at ₹ 1,57,220.04, followed by IFS-I with ₹ 1,35,625.20, and Non-IFS with ₹ 60,698.11.To maximize benefits, there was a need to promote IFS-II more widely among farmers. Efforts were suggested through Raitha Samparka Kendra (RSK) and Krishi Vigyana Kendra (KVK) to advocate for IFS adoption, thereby enabling more efficient use of farm resources and improving productivity and profitability for farming households.

Key words: Integrated Farming System (IFS), Crop, Dairy, Small ruminants.

Introduction

The Indian economy is predominantly rural and agriculture oriented, over the years declining trend in the size of farm holding poses a serious threat to crop based farming. Majority of the farmers concentrate mainly on crop production which is subjected to high degree of

uncertainty in generating sustainable income and creation of employment opportunity to farm households. In this context, it is crucial to evolve suitable strategy for augmenting the income of a farm. Integration of various agricultural enterprises viz., cropping, livestock, fishery, sericulture, mushroom, forestry etc., have greater potentialities in the agricultural economy (Dadabhau, 2014). These enterprises not only supplement the income of the farm households but also provide sustainable employment opportunity for farm households. Sharma (2019) found that IFS outperformed conventional farming in terms of productivity and environmental sustainability, with significant reductions in chemical inputs and improvements in soil fertility."

Integrated Farming System (IFS) is a multidisciplinary approach aimed to reduce the cost of production by recycling crop residues, increasing income by integrating more number of diversified cropping and agro-based enterprises, creating employment all through the year to small and marginal farmers. Therefore, IFSassume for effective and efficient management of farm resources to enhance farm productivity, reduce environmental degradation and improve income of resource poor farmers and maintain agricultural sustainability. Thus, IFS is based on the concept that “there is no waste”, and “waste is only a misplaced resource which can become a valuable material for another product” (Sutradhar, 2016). Integrated farming system increases economic yield per unit. It reduces production costs through recycling wastes and by-products of one enterprise as inputs to other enterprise. With the growing population and shrinking resources, vertical expansion through integrating appropriate farming components necessitates economic and sustainable crop production, ensuring periodic income flow to farm families.IFS in semi-arid regions of Rajasthan led to improved soil health and water use efficiency, resulting in higher crop yields and reduced input costs. This finding underscores the economic benefits of IFS over conventional farming practices, (Kumar 2017).

Karnataka has the highest area under dry land agriculture next to Rajasthan and is subjected to vagaries of nature with shrinking natural resource base and inefficiency in the management of natural resources, rural communities are exposed to predicament of drought constraining socio-economic development (Noorain, 2010). In this present context IFS is the only possible solution for continuous increase of demand for food production, stability of income and improvement in livelihood of farmers with limited resources. Since the study area lies in northern dry zone of Karnataka, farming was subjected to vagaries nature. Thus, potential to

raise production and income from dry land need to be improved with the integrated farming systems. The present paper attempted to identify the existing integrated farming systems in the study area and to estimate the cost and returns in the major integrated and non-integrated farming systems to suggest the appropriate farming system to enhance the farmers' income.

Methodology

Multi-stage random sampling technique was used for the selection of farmers. In first stage, Ballari district was selected and from this district, one taluk was selected in second stage based on the highest net sown area. In third stage, two villages were selected randomly from the selected taluk. From each selected village, 10 each of IFS and non-IFS farmers were selected randomly. Thus, the total sample size was 40 farmers. The primary data required for the study werecollected from the selected farm households using pre-tested schedule by personal interview method. Tabular analysis and budgeting technique was used for estimating costs and returns.

Inclusion/Exclusion Criteria: Farmers were included based on their participation in either Integrated Farming System (IFS) or non-IFS practices. Exclusion criteria were set for farmers who were not actively engaged in farming during the data collection period or those whose farming practices did not align with the study's definitions of IFS or non-IFS.

BC Ratio Formula: The Benefit-Cost (BC) ratio was calculated using the formula:

BC Ratio=[Total Benefits/Total Costs]

This ratio was used to evaluate the economic efficiency of the different farming systems by comparing the net returns with the associated costs.

Results and discussion

Identification of existing farming systems

The existing farming systems of sample farmers identified in Ballari district are presented in Table 1. For collection of primary data, 20 each of farmers practicing IFS and non-IFS were selected for the study. Among IFS farmers, 35 per cent of them have adopted IFS-I (Crop + Dairy) and 15 per cent have adopted IFS-II (Crop + Dairy + Small ruminants).

Cropping pattern of major IFS and non-IFS farmers in the study area

The cropping pattern and major farming systems adopted by sample farmers is presented in Table 2. The major crops grown during kharif season under IFS-I werepaddy (5.57 acre), dry chilli (1.93 acre) and cotton (1.79 acre), which contributed to 49.83, 17.26 and 16.01per cent of total cropped area. In rabi season, jowar and paddy were grown in an area of 0.82 and 1.07 acre, respectively. Net and gross cropped area of IFS-I was 9.57 acre and 11.18 acre, respectively with cropping intensity of 116.82 per cent. Dairy (3 buffaloes) was the allied enterprise in this system. In IFS-II, major crops grown in kharif season were paddy, dry chilli and cotton in an area of 3.33, 1.50, 0.50 acre, respectively. Paddy was the only crop grown in rabi season in an area of 1.00 acre. Dairy (2 buffaloes) and small ruminants (12 goats) were the allied components practiced in IFS-II. In non-IFS, mainly paddy and cotton were grown by farmers during kharif season in an area of 3.70 and 0.95 acre, respectively. In rabi season paddy was grown in an area of 0.65 acre. Net and gross cropped area of non-IFS was 4.80 acre and 5.30 acre, respectively with cropping intensity of 110.42 per cent. Paddy was the major crop grown during kharif and rabi seasons by the farmers of study area. This might be due to prevalence of rice processing units and irrigation facilities existing in that area (Raghavendra, 2012). Singh (2018) demonstrated that integrated farming systems significantly enhance farm income and sustainability, particularly through the integration of crops, livestock, and aquaculture. This supports the argument for adopting IFS to improve income stability and resource use efficiency."

Table 1. Existing farming systems identified in the study area (n=40)

SN	Farming systems	Enterprises	No. of farmers	% of adoption
1.	Integrated Farming System –I	Crop + Dairy	14	35.00
2.	Integrated Farming System –II	Crop + Dairy + Small ruminants	06	15.00
3.	Non Integrated Farming System	Crop	20	50.00
		Total	40	100.00

Table 2. Cropping pattern of major IFS and Non-IFS farmers

SN	Particulars	IFS-I (n=14)	IFS-II (n=06)	Non-IFS (n=20)

		Area (acres)	Per cent	Area (acres)	Per cent	Area (acres)	Per cent
I	**Crop**						
	Kharif season						
	1) Paddy	5.57	49.83	3.33	52.60	3.70	69.81
	1) Cotton	1.79	16.01	0.50	7.90	0.95	17.93
	2) Dry chilli	1.93	17.26	1.50	23.70	-	-
	Sub total	9.29	83.10	5.33	84.20	4.65	87.74
	Rabi season						
	1) Jowar	0.82	7.33	-	-	-	-
	2) Paddy	1.07	9.57	1.00	15.80	0.65	12.26
	Sub total	1.89	16.90	1.00	15.80	0.65	
	Gross cropped area	**11.18**	**100.00**	**6.33**	**100.00**	**5.30**	**100.00**
	Net cropped area	**9.57**	**-**	**5.50**	**-**	**4.80**	**-**
	Cropping intensity	**-**	**116.82**		**115.09**		**110.42**
II	**Dairy**						
	1) Buffallo	3	100.00	2	100.00	-	-
	Total	**3**	**100.00**	**2**	**100.00**	**-**	**-**
III	**Small ruminants**	**-**	**-**	**12**	**100.00**	-	-

Economics of IFS–I (Crop + Dairy)

The cost and returns of IFS-I was worked out and presented in Table 3. In this system, highest area was covered by paddy (6.71 acre) followed by dry chilli (1.93 acre), cotton (1.79 acre) and jowar (0.82 acre). Dairy enterprise with three animals was the allied enterprise adopted in IFS-I.

The total variable cost of IFS-I as a whole was worked out to be ₹ 5,38,512.34 accounting for 87.98 per cent of the total cost. Among different crops, the maximum cost was incurred for paddy ₹ 1,87,778.68 followed by dairy ₹ 1,30,868.00 , dry chilli₹ 1,45,328.00, cotton ₹ 61,503.88 and jowar ₹ 13,033.16.

The cost of cultivation was found to be maximum in paddy (₹ 2,16,737.03) followed by dairy (₹ 1,50,916.00), dry chilli (₹ 1,57,476.81), cotton (₹ 71,100.06) and jowar (₹ 15,852.65). The total variable cost and total cost of IFS-I was ₹ 5,38,512.34 and ₹ 6,12,082.66 respectively.

The benefit cost ratio was found to be highest in cotton (1.98) as compared to paddy (1.83), jowar (1.52), dairy (1.3) and dry chilli (1.26). As such, in gross returns, the share of paddy enterprise in farming systems was found to be highest (40.94 %) followed by dairy (21.53 %), dry chilli (20.54 %), cotton (14.51 %) and jowar (2.48 %). Similarly, in case of net returns the share of paddy was found to be highest (50.44 %) followed by cotton (19.47 %), dairy (16.15 %), dry chilli (11.63 %) and jowar (2.30 %). The gross and net returns realized under IFS-I was ₹ 9,68,453.77 and ₹ 3,56,371.11 respectively from 9.57 acre of land and three buffaloes.

The cost was found to be high in paddy as compared to other components. Because, the expenses incurred on human and machine labour andfertilizer was maximum for cultivating 5.71 acres of paddy.However, the sample farmers of the district cultivated cotton and dry chilli in kharif season due to availability of abundant water and suitability of agro climatic conditions for these crops.Paddy was grown both in kharif and rabi seasons. In rabi season, the area cultivated mainly depends on availability of canal water. During the study year, only few farmers have cultivated paddy in rabi season because of inadequate water facilities. Hence, the area share of paddy in farming systems as a whole was maximum in both kharif and rabi seasons. Patel (2015) highlighted that IFS significantly improved income levels and resource management among smallholder farmers in Gujarat, suggesting its potential as a strategy for alleviating rural poverty. Chand (2020) found that IFS in the Western Ghats of Kerala enhanced farm productivity and resource utilization, while also contributing positively to the region's ecological balance."

Table 3. Costs incurred and returnsrealised in IFS-I **(₹ / farm)**

Components of integrated farming system	Area (acres)	Cost (₹)			Returns (₹)		
		Total variable cost	Total fixed cost	Total cost	Gross returns	Net returns	B:C ratio
Paddy	6.71	187778.68 (86.64)	28958.55 (13.36)	216737.03 (100.00)	396501.17 (40.94)	179764.15 (50.44)	1.83
Cotton	1.79	61503.88 (86.50)	9596.28 (13.50)	71100.16 (100.00)	140479.20 (14.51)	69379.02 (19.47)	1.98
Jowar	0.82	13033.16 (82.21)	2819.49 (17.79)	15852.65 (100.00)	24054.70 (2.48)	8202.05 (2.30)	1.52
Dry chilli	1.93	145328.61 (92.29)	12148.19 (7.71)	157476.81 (100.00)	198934.75 (20.54)	41457.94 (11.63)	1.26
Dairy	3	130868.00 (86.72)	20048.00 (13.28)	150916.00 (100.00)	208483.95 (21.53)	57567.95 (16.15)	1.38
Farming system as a whole	9.57 + Dairy (3 Buffaloes)	538512.34 (87.98)	73570.51 (12.02)	612082.66 (100.00)	968453.77 (100.00)	356371.11 (100.00)	1.58

Table 4. Costs incurred and returns realized in IFS-II **(₹ / farm)**

Components of integrated farming system	Area (acres)	Cost (₹)			Returns (₹)		
		Total variable cost	Total fixed cost	Total cost	Gross returns	Net returns	B:C ratio
Paddy	4.16	121487.02 (84.35)	22534.93 (15.65)	144021.99 (100.00)	271910.60 (38.96)	127888.61 (50.31)	1.89
Cotton	0.50	17085.30 (88.55)	2208.27 (11.45)	19293.55 (100.00)	38429.56 (5.51)	19136.01 (7.53)	1.99
Dry Chilli	1.50	116029.65 (92.48)	9441.60 (7.52)	125471.25 (100.00)	156240.07 (22.39)	30768.82 (12.10)	1.25
Dairy	2	89521.95 (85.28)	15456.00 (14.72)	104977.95 (100.00)	149135.92 (21.37)	44157.97 (17.37)	1.42
Small ruminants (Goatary)	12	40326.34 (80.65)	9676.80 (19.35)	50003.14 (100.00)	82250.00 (11.78)	32246.86 (12.69)	1.64
Farming system as whole	5.50 + Dairy (2 Buffaloes) + Goatary (12 No.)	384450.25 (86.63)	59317.59 (13.37)	443767.87 (100.00)	697966.15 (100.00)	254198.28 (100.00)	1.57

Table 5. Costs incurred and returns realized in Non-IFS (only crop enterprise) **(₹ / farm)**

Components farming system	Area (acres)	Cost (₹)			Returns (₹)		
		Total variable cost	Total fixed cost	Total cost	Gross returns	Net returns	B:C ratio
Paddy	4.35	119386.49 (83.43)	23710.33 (16.57)	143096.86 (100.00)	231238.08 (77.88)	88141.22 (75.63)	1.62
Cotton	0.95	33056.39 (88.71)	4206.34 (11.29)	37262.71 (100.00)	65661.86 (22.12)	28399.16 (24.37)	1.76
Farming system as whole	4.80	152442.88 (84.52)	27916.67 (15.48)	180359.57 (100.00)	296899.95 (100.00)	116540.38 (100.00)	1.65

Table 6. Comparative economics of major IFS and non-IFS in the study area **(₹ / ha + livestock)**

SN	Particulars	IFS-I	IFS-II	Non-IFS
Costs incurred				
1	Variable Cost	237358.16	245576.45	79397.33
2	Fixed Cost	34029.85	40671.34	14539.93
3	Total Cost	271387.96	286247.80	93937.27
Returns realized				
1	Gross Returns	407013.16	443467.84	154635.40
2	Net returns	135625.20	157220.04	60698.11

IFS-I: Crop (1 ha) + dairy (3 No.)

IFS-II: Crop (1 ha) + Dairy (2 No.) + Small ruminants (12 No.)

Non-IFS: Crop (1ha)

Economics of IFS –II (Crop + Dairy + Small ruminants)

The cost incurred and returns realized in IFS-II is presented in Table 4. In this system,maximum area was occupied by paddy (4.16 acre) followed by dry chilli (1.50 acre) and cotton (0.50 acre). Gross cropped and net cropped area was 6.33 and 5.50 acre, respectively. Dairy (2 Nos.) and Small ruminants (12 Nos.) were the allied enterprises.

The variable cost incurred on paddy production was found to be highest (₹ 1,21,487.02) followed by dry chilli (₹ 1,16,029.65), dairy (₹ 89,521.95), small ruminants (₹ 40,326.34) and cotton (₹ 17,085.30). Similarly, the total cost of cultivation of paddywas ₹ 1,44,021.99 followed by dry chilli (₹ 1,25,471.25), dairy (₹ 1,04,977.95), small ruminants (₹ 50,003.14) and cotton (₹ 19,293.55). In case of IFS-II, the total variable cost and total cost were ₹ 3,84,450.25 and ₹ 4,43,767.87 respectively. The higher cost incurred for paddy and chilli production mainly due to allocation of more land for paddy and more input costs (seedlings, labour, fertilizer and pesticides) of dry chilli. Dairy incurred less total cost as compared to paddy and dry chilli.

As far as gross returns is concerned, the share of paddy was found to be highest (38.96 %) followed by dry chilli (22.39 %), dairy (21.37 %), small ruminants (11.78 %) and cotton (5.51 %). However, the net returns realized in paddy maximum (50.31 %) followed by dairy (21.37 %), small ruminants (12.69 %), dry chilli (12.10 %) and cotton (7.53 %). IFS-II generated gross and returns of ₹ 6,97,966.15 and ₹ 2,54,198.28 respectively from 5.50 acre of land, two buffaloes and 12 goats.

Economics of Non-IFS (only crop)

The cost incurred and returns realized from only crop enterprise is depicted in Table 5. The share of paddy was highest in gross cropped area (4.35 acre) followed bycotton (0.95 acre). Gross cropped and net cropped area was 5.30 and 4.80 acre, respectively with cropping intensity of 110.42 per cent.

The total variable cost incurred for the system as a whole was ₹ 1,52,442.88 accounting for 84.52 per cent of the total cost. Crop wise analysis revealed that, the variable cost was found to be highest in paddy (₹ 1,19,386.49) followed by cotton (₹ 33,056.39).

The share of paddy was found to be highest both in gross (77.88 %) and net returns (75.63 %).

However, the benefit cost ratio indicated that return per rupee of expenditure was found to be higher in cotton (1.76) as compared to paddy (1.62). For farming system as whole, the non-IFS generated gross and net returns of ₹ 2,96,899.95 and ₹ 1,16,540.38 respectively from 4.80 acre land with benefit cost ratio of 1.65.

Comparative economics of major Integrated Farming Systems and only cropping systems (Non-IFS) in Ballari district

The comparative economics ofmajor farming systems in Ballari district revealed that, the variable cost was maximum in IFS-II (₹ 2,45,576.45) followed byIFS-I (₹ 2,37,358.16) and non-IFS (₹ 79,397.33). Similarly, fixed cost was highest in IFS-II (₹ 40,671.34) followed byIFS-I (₹ 34,029.85) and non-IFS (₹ 14,539.93).The total cost incurred in IFS-II (₹ 2,86,247.80) was highest followed byIFS-I (₹ 2,71,387.96) and non-IFS (₹ 93,937.27). The gross returns was maximum in IFS-II (₹ 4,43,467.84) followed by IFS-I (₹ 4,07,013.16) and non-IFS (₹ 1,54,635.40). Similarly, a net return was highest in case of IFS-II (₹ 1,57,220.04) followed byIFS-I (₹ 1,35,625.20) and non-IFS (₹ 60,698.11). It is mainly because of more allied enterprises in the system.

Conclusion

The results of the study revealed that, majority of sample farmers in Ballari district practiced IFS-I predominantly (70 %) followed by IFS-II (30 %) and among major farming systems, IFS-II (Crop + Dairy + Small ruminants) generated more profit than other farming systems inview of involvement of more subsidiary enterprises *viz.* dairy and goatary. The component of livestock in the identified farming systems not only generated continuous income throughout the year but also provided an opportunity for effective recycling of residues in the farm besides creating employment for the households throughout the year. Appropriate combination of crops with livestock generated more income than only cropping. Hence,farmers are to be advised to take up these enterprises in the study area. Efforts need to be made through Raitha Samparka Kendra (RSK) and Krishi Vigyana Kendra (KVK) to popularize these farming

systems to utilize farm resource efficiently to enhance productivity and profitability of farm households. The study faced limitations such as a relatively small sample size and potential biases in self-reported data. Additionally, the focus on a single district may not fully represent broader regional variation. Future research could expand to include a larger sample size across multiple districts to enhance generalizability. Studies could also explore the impact of more recent agricultural trends and technologies on farming systems. Further research might investigate the long-term sustainability and economic impacts of IFS compared to other farming systems.

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